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# **The Nature of Economic Development Zones in China**

——An Empirical Study Based on Data from the Yangtze River Area

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# The Nature of Economic Development Zones in China

——An Empirical Study Based on Data from the Yangtze River Area<sup>①</sup>

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**Abstract:** Development zones, born in the course of China's economic transition, are the carriers of both the favorable institutions and the foreign advanced technology. They are now at the stage of transferring from the concentration of firms to being industrial clusters. Based on data of firms in development zones along the Yangtze River obtained through micro-level investigation, this paper studies the effects of local factors special to development zones as well as the influence of technology promotion on the economic performance of those firms "locating" in development zones, and thus discloses the nature of firms concentrating into development zones and their trend of transferring into industrial clusters. The empirical study suggests that firms locating on development zones mainly aim at obtaining "policy rents", which results in that firms concentrating in development zones do not possess the industrial cluster effect in the general sense: the benefits of closing to the supply or demand market. However, although firms in a development zone do not necessarily concentrate with related firms in space, their technology and market activities are inevitably to produce relations with factors such as local governments and related industrial elements and thus affect the economic performance of firms and nurture the clustering effects of development zones. Therefore, as "policy rents" fade away due to industry transfer and adjustment of favorable economic policies, the key to keep development zones sustainable is to enhance their clustering effects.

**Keywords:** development zones along the Yangtze River, spatial concentration of firms, industrial clustering effect, technology promotion, policy rents

**JEL Classification:** L10, O12, O25

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## **1. Introduction**

It is a universal method for developing countries to establish economic development zones and attract foreign capital as to increase job opportunities, promote export and economic growth. Since 1984, China has started building economic development zones; in around 2000, the development of development zones reached a climax along with the increasing deepening of global labor division brought by transnational manufacturing firms. The development zones along the Yangtze River in Jiangsu province have displayed a trend of fast development with Kunshan county of Suzhou city as the representatives. A large number of foreign manufacturers have quickly located in development zones along the Yangtze River and foreign firms from different countries and industries with diverse scales often locate in the same development zone, which shows the “concentration” characteristic. After fast expansion and due to the limitation of land planning area, development zones gradually enhanced criteria of firm scale and industrial affiliation, thus new foreign firms falling below the criteria have to gradually locate to the less developed areas. Some firms that used to be in the development zones along the Yangtze River have moved to the northern part of Jiangsu province as well.

In consideration of the fact that development zones compete to adopt policies and measures with lower investment cost to attract foreign capital, a question emerged from the changes of development zones along the River, that is, is this firm concentration based on development zones the real industrial clustering or not, namely, has it led to industrial cluster effect. If firms locate into development zones only for “concentration”, then their contributions to the local economic growth will only be GDP growth within a few years, which have victimized the capacity of long sustainable development. In contrast, if these firms have formed industrial cluster effect, then this area will have these firms stay and spur the development of local firms as to foster the capacity of sustainable development. Even when these firms relocate to the northern area of Jiangsu province, the rise of transportation cost will be counteracted and industrial affiliation effect and overflowing effect will be expanded in a greater geographical extension as to diminish the development gap among different areas.

Therefore, based on the questionnaire survey and empirical tests concerned with location motivation, technology promotion after location and economic benefits of firms in development

zones along the Yangtze River, this paper attempts to disclose the answers to why firm clusters show a concentration characteristic in the initial stage and whether their later development forms industrial cluster effect or not so as to provide objective evaluation and suggestions for the development of industrial clusters based on development zones.

The following part will make a brief review over relative researches on industrial clusters and development zones; the third part will make theoretical analysis on the nature of spatial clusters formed by firms attracted by the government's "policy rents" and to propose three hypotheses to be measured and tested; the fourth part will make statements on data and variables; the fifth part will establish an econometric model to test the impact of spatial cluster factors and technology promotion factors on economic performance of firms in development zones; the sixth part makes further illustrations on the consistency between theoretical hypotheses and the test results; the last part concludes the paper and indicates the policy implications.

## **2. Literature Review**

A large number of theoretical researches attribute spatial cluster of firms to advantages of resource endowment, transportation cost, scale returns based on fixed cost, specialized suppliers, labor markets and external economy based on knowledge spillover as well as negative effects brought by firm cluster such as land rent rise that leads to increase on general expense of industrial manufacture (Web, 1909; Marshall, 1890; Dixit & Stiglitz, 1977; Krugman, 1991, 1998) . Krugman (1991) furthered the idea that the formation of industrial zones also holds the characteristic of path dependence, namely, the accidental concentration of firms as well as the continuous self-accumulation and self-strengthening of external economy brought by clustering increasingly enhances the power of clustering.

Porter (2000) made further emphasis on the promotion function of relative supporting industrial and governmental policies towards industrial cluster. Martin and Rogers (1995) found that when there are increasing returns, improving domestic public infrastructure is favorable for attracting foreign capital while improving infrastructure for the convenience of international trade will lead to outflow of domestic firms to abroad. Meyer-Stamer (1999) studied the history of industrial cluster in Santa Catarina, Brazil and found that successful industrial district depended

not only on national and regional government policies as well as institutional arrangements but also on cooperation and interaction among firms, guilds and other participators. Although governments play an important role in the formation of advantageous industrial district, Brazil provinces lacked not just powerful policies in promoting district advantages but the industrial policies were affected to a great extent by political activities. With regard to this, the strength of economic development zones should shift from the conventional top-down policy-driven style to the networking style promoting good development of firms based on the systematic competitive advantages. Porter (1990) thought that advantages of industrial area could not be built within a short term but came out of long-term development and constant differentiation. This kind of advantages will not be copied by other areas; and once formed, it can enhance the power of local governments in the negotiation with firms because the irreplicable location advantages will make the firms willing to stay.

Even if the government plays an active role in building development zones from the aspects of institution supply, sound laws and favorable policies etc., its direct interference with industries tend to give rise to negative effects. Economic achievements in Japan, Korea and other Asian countries are generally considered as the result of government-led economic development. However, Porter, Takeuchi Hirotaka and Mariko Sakakibara (2002, Chinese translation) held a completely opposite view: Industries with direct interference of the government were losing competitiveness constantly, while industries with sufficient competition and less governmental interference grew to be the pillar industries of Japan. Where the government plays an active role only lies in educational training, infrastructure construction, enacting legal criteria and stabilizing macro political environment and so on. In recent 40 years, the regional development plans carried out by Brazil through financial policies failed to make fundamental changes to the fact of fast-developing in the southeast and backwardness in the northern areas. Although a large sum of financial subsidiary and tax support policies made Manaus free trade zone in northern Brazil able to achieve good economic performance but the proliferation effect of this growth pole was not obvious (Lall, 2004).

In developing countries, that firms take advantage of favorable policies to locate in development zones involves a great deal of FDI activities. The enormous researches concerned with economic benefits of FDI focus on management spillover effect (Yuan Cheng, Lu Ting,

2005), spillover effect of technological and scientific researches (Johansson, H. and L. Nilsson, 1997; Lai Mingyong et al, 2005; Jiang Dianchun, 2006; Cai, Todo, and Zhou, 2007) as well as industrial spillover effect based on the markets (Zhong Changbiao, 2006). Besides, Javorcik and Spatareanu (2008), from the perspective of the property rights structure (joint-venture or single proprietorship) of FDI firms, used the data of Romanian firms and concluded that FDI in joint-venture possesses obvious spillover effect. Different from these researches, this paper takes the perspective of the function of firm cluster in development zones to study the spillover effect that encourages the location of firms. This overflow effect often is led by governments and not borne within the spatial concentration of firms. Du, Lu and Tao (2007) combined the institutional factors and cluster factors to explain FDI behaviors and believed that the public institutions for property rights protection provided by development zones is the main reason of FDI. However, based on a theoretical model, Amiti (2005) and Amiti & Javorcik (2008) undertook an empirical study on the industrial data of Chinese provinces, indicating that the key factor that affects entrance of foreign capital is whether close to the market or suppliers. Also different from the previous researches, this paper is based on development zone samples under the assumption of “policy rents” to show that foreign capital entrance is not motivated by the advantages of close to the market or suppliers.

To sum up, related literatures provide both theoretical and empirical reference for us to understand the formation of firm cluster based on development zones, its effect and the function of governments. However, these literatures mainly take a perspective of the whole industry or the macro data, but researches based on micro data of firm level to study the motivation of firm clustering in development zones, whether location forms industrial cluster effecter or not, whether the formation of industrial cluster effect continues to be affected by the governmental factors in development zones is rare, and this paper takes utilizes the questionnaire data collected from firms in development zones along the Yangtze River to make up the literature inadequacy mentioned above.

### **3. Industrial Clusters Based on Development Zones: Theoretical**

#### **Hypotheses**

Development zone is a way of incremental development employed by developing countries to launch economic development, which is determined by shortage of capital investment and market system for economic development in developing countries. In the initial stage of development, developing countries, including China, have a large amount of labor resources and land as well as other production factors in rural areas and their industrial sector and city scales stand relatively small. Lewis and Todaro, as the representatives of neo-classical economics, regarded the process of economic development as the process of rural labor and population moving to industrial sectors and cities, along with which a great area of rural land will be increasingly engrossed by urbanization and industrialization. This perspective of development has a hidden hypothesis of market validity, namely, faced with the temptation of enormous demands in domestic and foreign markets, industrialized capital will constantly input investment and absorb large amount of labor for that benefits of marginal products rise high above labor wages (which decide the marginal cost); and the accompanying urbanization will also lead to higher income expectation and attract more influx of labor at all levels. But this hidden hypothesis does not exist in developing countries. The fact in developing countries is that they are short of market systems. This fact has led to morbidity of market mechanisms and market failure; most importantly, property rights cannot receive effective protection and contracts cannot be implemented in practice. On this occasion, existing urban sectors, especially the administrative government departments will interfere in property rights and contracts involved in capital investment. Even if there are capital investments, these capital investments cannot put into use or expand unless they can keep advancing vested interests. Therefore, the ratio of capital returns is largely rebated and indefiniteness of investment grows much bigger. The result is shortage of capital investment especially external capital investment, and the speed of labor-absorption and economic development is largely slowed down. This slowdown maintains the shortage of market systems and finally forms a vicious cycle of development as “deficiency of market systems leads to shortage of capital investment which in turn leads to more severe deficiency of market system.” Another result will come out that vested interests stop increasing.



To realize economic growth, enough amount of capital investment should be acquired. But institutions that keep market failure have a characteristic of path dependence; their change can hardly meet the needs of attracting large-scale capital investment. Under this circumstance, to break through this dilemma of development, a feasible method is to implement incremental development, that is, to build a new area outside the administrative system of the city government and carry out effective protection of property rights and implementation of contracts as to solicit capital investment. This special area is known as economic development zones or special economic regions.

Capital is borne egalitarian. Developing countries and regions compete for capital investment and capital choose to enter countries and regions with the lowest investment cost and highest investment returns. There are many factors that affect investment cost but at the stage of choosing investment “location”, the direct factors that affect capital investment include land cost, tax rate, scale economy of infrastructure (especially facilities for transportation and communication), convenience of customs clearance, and quickness of logistics and so on. In developing countries, these factors all fall under the control and adjustment of the government. In consequence, the government not only promises protection of property rights in development zones but manage to lower direct investment cost even at the cost of existing financial revenue for providing these elements. Since these measures can only be implemented inside development zones, the excessive policy benefits of firms inside the zones actually become some kind of “rent” compared with the original system and region. We herewith propose a “policy rents” assumption: economic development zones, as the government-led carriers of economic growth, initially attract investment with favorable policies in finance and tax —“policy rents” and firms locating into development zones aims at these rents.

With this assumption, the variable space that decides whether firms locates into development zones or not is enlarged. In the war of business and investment-attracting among local governments, a large enough amount of “policy rents” will cause firms spatially concentrated with non-spontaneous cluster effect. Hence we propose hypothesis 1:

**Hypothesis 1: When local governments compete to attract business and investment with the weight of “policy rents”, the firm “concentration” thus caused does not possess industrial**

**cluster benefits in a conventional sense.** <sup>①</sup>

Firms locate in development zones pursuing “policy rents” and once they settle down, the firms will inevitably establish trade relationships with all kinds of interested parties (factor owners). Local governments certainly are the main object of gaming relationship with firms inside development zones. But as soon as a firm “locates” in the development zone, it means that it has carried out various kinds of “specific investment” including fixed assets, staff recruitment, and training of specific corporate ability and so on. In other words, firms cannot retreat without any loss, which means firms might face the “hold up” of local government. Nevertheless, bounded by the repetitive gaming space between the government and the firm and the reputation for attracting prospective entrants, this violation of agreement can often be refrained effectively. And as long as more firms cluster, the bargaining power and the power against infringement of property rights of firms over the government will increase (Du, Lu and Tao, 2007). A typical fact is the worse the mechanism for property rights protect and economic performance of an area is, the more willing firms will be to enter its economic development zones because development zones as “institutional enclaves” will effectively protect firms from grapping. Nonetheless, it will not change the leading role that the government plays in the game relationship with firms in development zones but change the content of their game: from potential grapping game to supporting game. Another major game relationship comes from the transaction relationships out of business correspondence of firms based on product value chain. The game subjects involve technology, labor, raw material suppliers and dealers etc.. In this process, there are necessarily spillover benefits from various aspects such as technology, management, market and so on (Jiang Dianchun, 2006; Cai, Todo & Zhou, 2007; Javorcik 和 Spatareanu, 2008). But as long as the major motivation of firms locating into development zones is “policy rents”, a possible conclusion will be: connection among firms will not be affected by spatial distribution (concentration or decentralization).

**Hypothesis 2: at the assumption of “policy rents”, firms and governments as well as other related main bodies will definitely enhance connection, but this kind of exchanges does not necessarily base on spatial concentration.**

The two hypotheses above mainly study under the assumption of “policy rents” the game

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<sup>①</sup> so called “pecuniary externality” (Krugman, 1991) brought by close to market demand and factor supply.

relationship between firms inside development zones and stakeholders. But in the background of global capital and technology transferring to low-cost countries on a large scale, selection of technological behaviors will be the main channel for firms to obtain good performance and thus increase competitiveness. The channel includes two ways: one is the outcome of governmental behaviors, namely, the government support firms in technological promotion activities through financial or fiscal policies; the other way indicates the technology promotion activities that firms carry out by utilizing the interaction between them and stakeholders inside and outside development zones. So to speak, if in the frame of established policies, the remaining “policy rents” are the common resources of firm performance in development zones, and then technological choice of firms should be the specific resource of firm performance in development zones. Thus, we have hypothesis 3:

**Hypothesis 3: Firms concentrated in development zones substantially promote their economic performance and competitiveness through technology promotion activities.**

In summary, development zone is the spatial carrier for developing countries to attract foreign capital with special policies outside original civic and administrative framework. It is the favorable policies and infrastructure constructed through financing by the government but not the native endowment and framework of development zones that voluntarily evolves to promote firms to cluster in development zones. Such kind of firm clustering naturally does not possess economic externality characteristics of general industrial cluster. Policy privileges and the government’s promise on protection of property rights and implementation of contracts actually show the equilibrium of the game between the government and overseas-funded firms. After foreign-owned firms locate into development zones, out of the needs of technological promotion and improvement, various reciprocities within overseas-funded firms, between overseas-funded and local firms, between overseas-funded firms and local labor, between technicians and administrators will emerge. And industrial cluster effect gradually reveals itself and enhances economic performance of firms and competitiveness of development zones, thus finally turning into an industrial cluster.

Based on hypotheses proposed, the following parts will utilize the investigation data from firms in development zones along the Yangtze River and make empirical tests on its logical coherence through econometric regression and sample analysis.

## **4. Data and Variables**

### **4.1 Data**

The 244 samples we collected from investigation on development zones along the Yangtze River in Jiangsu province in 2005 have 241 valid samples. The content of questionnaires includes three parts: firm profile, firm technology promotion in complete sets, firm owner profile. The firm profile comprises of firm ownership, scale, business line, years of operation, economic performance, firm level in the industry, operational manner; technology promotion in complete sets include firm's motivation of entering the development zone, relationship with firms in upper and lower reaches, state of human resources and experience in industrial promotion and adjustment etc.; owner profile includes the owner's gender, age, education background, income and working years and the like.

The firms under investigation in development zones along the Yangtze River are located in 8 cities as Suzhou, Jiangyin, Nanjing, Changzhou, Taizhou, Zhenjiang, Nantong and Yangzhou, the first four of which belongs to the south of Jiangsu while the rest four belongs to the north of Jiangsu. In 241 valid samples, the south of Jiangsu has 98 samples and the north of Jiangsu has 143. Changzhou and Nantong have over 50 firms under investigation, respectively 55 and 56 firms in exact number. Zhenjiang, Yangzhou and Jiangyin respectively have 39, 35 and 28 firms under investigation. The samples of these five cities take up 87.3% in total samples. Sample firms mainly lie in three industries: textile, chemical raw material and chemical manufacture, and machinery, electric and electronic equipment manufacturing, which covers 142 firms in all, taking up 58.2% of the sample totality. In terms of ownership, state-owned collective firms account for a small proportion for 10 firms in all; only Nanjing has one state-owned firm in this study; private-owned, foreign-funded and Hong Kong, Macau and Taiwan-funded firms are well-matched in strength, respectively having 56, 68, 53, 40 firms in this investigation. In terms of firm scale, the prevalent scales are small and medium sizes with medium-sized firms for 108 and small-sized firms for 95, accounting for 83.2% in all samples. And there are 4 super-large scale and 33 large scale firms. Considering this, the competition among firms in development zones is in good form because oligopoly or monopoly firms are few so that economic performance of firms

rely only a little of monopoly profits. In terms of operating years, most firms in development zones are new ones with only 7 firms having a history before 1970s, 109 firms operating since 1980s and 1990s and 120 firms established after 1990s. Therefore, most firms in development zones along the Yangtze River are newly-established firms.

## 4.2 Variables

*Dependent variable.* This paper chooses firm performance (FPER) as the dependent variable.<sup>①</sup>

*Independent variables.* (1) The economic effect of spatial concentration. We use the effect of firm link (FLIN) between firms in lower and upper reaches on firm performance to measure it.<sup>②</sup> This variable comprises of the link of firms in development zones with suppliers (FLIN1) and dealers (FLIN2). Although the empirical study based on Chinese industrial data and carried out by Amiti and Javorcik (2008) suggested that close to markets or suppliers will significantly increase profits of firms and thus attract more firms to locate. But based on hypothesis 1 and 2, we can predict that these two variables will show no obvious influence on economic performance. (2) Economic effect of technological promotion and improvement in firms. We utilize effect of the choice of firm technology promotion on economic performance (FTEC) as measurement.<sup>③</sup> In line with hypothesis 3, we expect a positive effect of technology promotion and improvement towards economic performance in firms.

*Control variables.* To enhance robustness of results and not to neglect other factors that might affect firm performance, we will introduce two types of control variables: one type of variables is control variables of firm characteristics (FCHA) and the other is control variables of owner (administrator) characteristics (OCHA).

Firstly, the following are characteristic variables of firms: (1) Firm size (FSIZ). Firm size may affect firm performance, and we will use the number of personnel in firms as obtained from

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<sup>①</sup> This data is a degree variable, and firms under survey will choose from five options varying as “very good, just good, normal, bad, very bad” based on their economic performance in 2004. And for these five options, we will assign the values to them in return “5, 4, 3, 2, 1.”

<sup>②</sup> This variable is a dummy variable. If firms in development zones along the Yangtze River cluster with firms located in the upper or lower reaches, then the value of this variable is 1, otherwise 0.

<sup>③</sup> This is a dummy variable. Based on the design of questionnaires, for the question “has your firm gone through technology promotion or improvement recently”, if the answer is positive, this variable will be assigned value as 1, otherwise as 0.

questionnaires for measurement. (2) Firm level among peer firms (FLEV). <sup>①</sup> (3) Creation time of the firm (CTIM). This variable is used to decide whether firms have the characteristic of “path dependence”. A long creation time means the firm can “last forever” and its economic performance will be good. However, due to the special corporate system of China, i.e. state and collective owned corporate system, that a firm can last doesn’t inevitably come from its good economic performance. Therefore, this variable has no definite influence on firm performance. (4) Proportion of local employees (ECON). According to hypothesis 2, local employees may facilitate the operation of firms by using their relationship network. <sup>②</sup>

Secondly, there are the characteristic variables of owners (or administrators): (1) Education background of firm owners (hereafter referred to as EDU). In accordance with theories of human capital, enhancing the education level will improve the ability of firm owners and thus improve economic performance of firms. <sup>③</sup> (2) Age of the chief executor (hereafter referred to as AGE). The older the owner is, the more experienced he or she is and thus the owner will contribute more and better to the development of the firm. (3) Relevant Time for the chief executor to do the similar business before he or she entered the firm (hereafter referred to as RTIM). The longer the chief executor engages in the similar business, the better he or she will be in enhancing firm performance. <sup>④</sup> Descriptive statistics of all variables are presented in Tab.1.

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<sup>①</sup> This index is also degree variable, just as the explained variables. Firm levels among firms of the same industry (FLEV) vary from “leading internationally, better than the international medium level, average international level, leading domestically, better than the domestic medium level, average domestic level, worse than domestic medium level”, thus assigned values from 8 to 1.

<sup>②</sup> Here included are several sub-variables as follows: the proportions of local employees respectively in normal employees in the firm (ECON1), average technicians (ECON2), senior technicians (ECON3), medium-level administrators (ECON4) and senior administrators (ECON2).

<sup>③</sup> We assort the samples into three education levels and process them with multiple dummy variables: middle school (including junior school and high school indicated by EDU1), vocational training school (indicated by EDU2) and college (indicated by EDU3).

<sup>④</sup> Here the indexes of measurement are two: one is “relevant time doing the similar business (indicated by RTIM1)” and “working time in the firm until 2004 (indicated by RTIM2).”

Tab.1 The descriptive statistics of all variables

Variables	Sample s	Mean	Stan. Dev.	Minimu m	Maxim um	Remarks
PFER (firm performance)	226	3.491	0.756	1	5	Degree variables
FLIN1 (firm link to suppliers)	207	0.174	0.38	0	1	dummy
FLIN2 (firm link with dealers)	212	0.156	0.363	0	1	Dummy
FTEC (firm technology choice)	204	0.593	0.492	0	1	Dummy
FSIZ (firm size)	227	454.784	676.189	4	4600	Unit: people
FLEV (firm level)	237	3.983	1.884	1	8	degree
CTIM (creation time)	239	7.251	7.793	0	47	Unit: years
ECON1 (normal employees)	200	0.721	0.27	0.02	1	proportion
ECON2 (average technicians)	192	0.742	0.261	0.02	1	Proportion
ECON3 (senior technicians)	158	0.643	0.318	0.01	1	Proportion
ECON4 (medium-level administrators)	183	0.744	0.282	0	1	Proportion
ECON5 (senior administrators)	159	0.725	0.311	0.01	1	Proportion
EDU1 (middle school)	225	0.2	0.401	0	1	Dummy
EDU2 (vocational training school)	227	0.502	0.501	0	1	Dummy
EDU3 (college)	231	0.281	0.451	0	1	Dummy
AGE (age of the chief executor)	218	38.569	10.205	19	70	Unit: years
RTIM1 (relevant time not in the firm)	222	11.083	8.268	0.33	40	Unit: years
RTIM2 (relevant time in the firm)	219	6.426	6.468	0.4	37	Unit: years

## 5. Empirical Tests

### 5.1 Empirical Model

Based on the data and variables above, we come out with the following empirical model:

$$FPER_i = \beta_0 + \sum \alpha_j FLIN_{ji} + \beta_1 FTEC_i + \sum \lambda_m FCHA_{mi} + \sum \gamma_n OCHA_{ni} + \varepsilon_i \quad (1)$$

where  $\varepsilon$  stands for random error term;  $i$  indicates firms under survey;  $j$  stands for the type of link between firms and related firms: if  $j=1$ , it represents the spatial relationship between firms and suppliers while  $j=2$ , it represents the spatial relationship between firms and dealers.  $m$  and  $n$  respectively stand for the number of characteristic variables for firms and owners. In order to avoid multiple-colinearity, we adopted OLS stepwise regression approach to exclude some defective variables.<sup>①</sup> Meanwhile, Tab. 2 provides the econometric results that suggest almost every variable's effect on economic performance of firms in development zones.

### 5.2 Empirical Results

According to Tab.2 and statements on variables above, we can conclude that:

*Whether firms in development zones spatially concentrate with related firms in the upper reaches and lower reaches has no significant influence (all regressions in tab.2 except for (5)) on their economic performance.* Opposite to the econometric results of macro data by Amiti and Javorcik (2008), we found that the sources of economic performance for firms in development zones do not come from the traditional benefits of “close to the factors” or “close to the market” but that policy privileges prompt firms to locate in development zones, which is a powerful support to hypothesis 1.

*Technology promotion and improvement in firms have significant and positive influence on economic performance in firms (all regressions).* In details, technology promotion in firms will improve economic performance by 0.2 to 0.5 scale compared with those who do not. Consequently, hypothesis 3 is well proved.

*Influence of firm characteristics on firm performance. CTIM has a negative influence on firm performance but not significant (according to regression (2)).* This might due to “the restraint of

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<sup>①</sup> In order to ensure a robust and reliable result of OLS regress adopted in this paper, we also employed Breusch-Pagan/ Cook-Weisberg approach to test whether there was heteroscedasticity, but the result could not deny the original assumption of homoscedasticity; meanwhile the test is conducted on the distribution of residual error of regression and the result suggested that it follows normal distribution basically; Adopting robust regression estimation, and the results differs very little from the result of OLS. Given the limitation of paper length, these test results are not reported in the paper.



soft budget” in a large number of firms. FSIZ and FLEV are positively related to economic performance of firms. The proportions of local employees in various types of employees have little influence on firm performance, even neglectable ( $R^2$  is too small to be reported in the Tab.2). However, when the proportion of local employees in medium-level administrators (ECON4) carried out separate regression, it showed significant promotion to firm performance (see regressions (3) to (5)). This conclusion complies with hypothesis 2: in the game process between firms in development zones and governments, administrators familiar with local game rules are needed. Although many senior administrators are appointed by parent companies, the benefits of firms will be enhanced if medium-level administrators are local employees.

*Influence of individual characteristics of owners (administrators) on firm performance.* Compared with middle school education, vocational training and college education of owners did not significantly increase economic performance of firms (see regression (6)); but receiving middle school education (EDU1) showed significant positive influence on firm performance compared with receiving other kinds of education (see regressions (4) and (5)). So, fundamental education exerts bigger influence. When AGE, RTIM1 and RTIM2 regressed together, they showed no influence on firm performance; but if they regress separately, AGE and RTIM1 indicated negative influence on firm performance (see regressions (3) to (5) and (7)).

On the whole, the conclusion of econometric tests is relatively robust: even though the explaining variables vary in choices, yet variables on cluster effect and technological actions concerned by this thesis showed steady influence on firm performance. The items such as selection of firm technology, firm scale, firm level, the number of local employees in medium-level administrators, middle school education and age had very significant influence on firm economic performance—all the explaining variables are significant at the level of 5% and the degree of fitness is just fine ( $\text{Adj-}R^2=0.295$ , see regression (5)). So to speak, our econometric model has testified hypothesis 1 and 3 and verified hypothesis 2 preliminarily.

Tab.2 cluster effect, technology promotion and economic performance in development-zone firms

Explaining variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
FLIN1 (suppliers)	-0.021 (-0.11)	0.045 (0.25)	-0.026 (-0.15)			0.053 (0.27)	-0.129 (-0.69)
FLIN2 (dealers)	-0.159 (-0.78)	-0.236 (-1.22)		-0.029 (-0.16)		-0.215 (-1.00)	-0.080 (-0.37)
FTEC (selection of technology)	0.353 (2.89)***	0.261 (2.18)**	0.236 (1.85)*	0.273 (2.21)**	0.327 (2.87)***	0.413 (3.29)***	0.245 (1.99)**
FSIZ (by employees)		0.0003 (2.9)***	0.0002 (2.44)**	0.0002 (2.50)**	0.0002 (2.23)**		0.0001 (1.30)
FLEV (firm level)		0.092 (2.65)***	0.097 (2.58)**	0.101 (2.88)***	0.104 (3.28)***		0.133 (3.21)***
CTIM (creation time)		-0.003 (-0.41)					
ECON4 (medium-level administrators)			0.606 (2.75)***	0.525 (2.52)**	0.567 (3.00)***		
EDU1 (middle school)			0.195 (1.23)	0.268 (1.87)*	0.301 (2.28)**		
EDU2 (vocational training school)						-0.164 (-0.99)	
EDU3 (college)						0.137 (0.75)	
AGE (age)					-0.014 (-2.61)***		0.002 (0.27)
RTIM1 (relevant time in business)			-0.015 (-2.07)**	-0.016 (-2.29)**			-0.008 (-0.95)
RTIM2 (time of appointment)							-0.007 (-0.63)
CONS (constants)	3.321 (33.23)***	2.944 (18.43)***	2.582 (10.65)***	2.606 (10.7)***	2.924 (10.12)***	3.316 (20.27)***	2.911 (9.63)***
Adj-R <sup>2</sup>	0.041	0.187	0.232	0.249	0.295	0.059	0.214
F value	3.26	6.52	5.86	6.87	10.05	2.87	5.28
samples	160	145	114	125	129	150	127

Note: Values in parentheses are t-value. “\*”, “\*\*” and “\*\*\*” respectively denote significance

levels of 10%, 5% and 1%. The software used here is STATA8.0.

## 6. Further Discussions on the Robustness of Hypothesis and Test

### Results

#### 6.1 The first source of performance for firms and the development zones: related companies and governmental supports

##### *Discussions on the assumption of “policy rents”*

Since the assumption of “policy rents” is the basis of the three hypotheses, its realistic rationality directly determines the persuasiveness and robustness of hypotheses in this paper. Due to that data in this thesis does not include that of non-development zones, it’s impossible for us to conduct valid econometric tests on the assumption of “policy rents”, which is why we called it “assumption” but not “hypothesis”. Nonetheless, still we can test it with existent samples. In reality, it’s a universal phenomenon that economic development zones attract firms by providing financial or tax privileges and choosing to locate in development zones is a rational choice of firms. For local governments are lack of capital and absolute location advantages, the policy variable in their hands is quite flexible: adjusting the value of “policy rents” is to change the ratio of cost to benefits for potential firms. In this sense, development zone is not just the carrier of spatial “concentration” but also “institutional enclaves.” Firms managing to locate in development zones are all firms that expect their net profits to be positive. Tab.3 further proved that among various kinds of location motivations for firms to locate in development zones, the tax and land privileges as well as infrastructure provided by the government are the decisive factors while conventional cluster effect doesn’t count.<sup>①</sup> So, the hypothetical assumption of “policy rents” in this thesis holds strong realistic rationality.

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<sup>①</sup>Here, the ranking is obtained through the following calculation: multiply the quantity of the chosen orders of each item with the weight value of each order and then accumulate the sums. For example, the item “the coordination ability of raw materials and so on” in samples has the quantities of different orders as 5, 4, 3, 4, 5, 3, 1 and the weight values of different orders are respectively 7, 6, 5, 4, 3, 2, 1, then the weight value of this motivation is 112(=5\*7+4\*6+3\*5+4\*4+5\*3+3\*2+1\*1). Such calculation not only reflects the chosen number of an item but also the importance of this item and thus the ranking is more convincing.

Tab. 3 ranking of motivations for firms to locate in development zones in different cities

Motivations	Changzhou	Taizhou	Jiangyin	Zhenjiang	Nantong	Yangzhou	overall
Coordination ability of raw materials and so on	7	7	6	6	6	7	6
Labor quality and cost	5	1	5	5	4	5	5
Tax privileges	1	2	1	2	1	1	1
Land privileges	3	3	2	1	2	2	2
Infrastructure provided by development zones	2	4	4	3	3	3	3
Market potential of China	4	5	3	4	5	4	4
Cooperation opportunities with leading companies	6	6	7	7	7	6	7

*Interaction between development-zone firms and their related companies*

The empirical tests above have already showed the relationships among variables, but whether the underlying relationships among variables are carried out by the government-led development zones needs further explanation. Our tests have already indicated that firm performance has nothing to do with spatial “concentration” of firms, which however, only suggests that information exchange among firms relies little on spatial concentration. Statistics of samples further supported this conclusion that in all samples, 70% suppliers and 73.4% dealers do not lie in the same district with development-zone firms and only 14.8% and 13.5% suppliers and dealers locate with development-zone firms with deals more scattered than suppliers. But this doesn’t mean firms in development zones have no information exchange within themselves or with other firms outside the zones.

Tab. 4 presents the ways that firms in development zones get in touch with related firms in upper or lower reaches. The ways of connection mainly focus on product quality and market information, and firms of lower reaches play a more important role in providing market information than firm of upper reaches. Market information includes market capacity, total value and structure etc.. In terms of guaranteeing product quality, the situation is the other way round. Similarly, firms in lower and upper reaches have different functions in technology promotion of firms. We can thus conclude: different from the spillover effect analysis based on FDI firm property structure by Javorick and Spatareanu (2008) , the spillover effect of development-zone firms is led by market information exchange which is not carried out by spatial concentration.

Tab. 4 connections between development-zone firms and related firm of lower or upper reaches

Ways of connection with firms in upper reaches	Number of votes	Ways of connection with firms in lower reaches	Number of votes
Help to reach reliable quality requirements	142	Help to reach reliable quality requirements	120
Help renew technologies	43	Help renew technologies	62
Help shorten response time	69	Help shorten response time	66
Provide fund support	28	Help deliver on time	84
Provide market information	83	Provide fund support	34
Other supports	3	Provide market information	121
		Other supports	4
N/A	60	N/A	52

*The relationship between development-zone firms and the government: discussions on hypothesis*

2

Another key aspect for internal information exchange in development zones is the information exchange between firms and the government. The assumption of “policy rents” has been supported that firms locating in the development zone are to pursue “policy rents” but not cluster benefits; hypothesis 2 points out that the supportive measures from the government exerts positive influence on firms. Therefore, inside the economic development zone, the interaction between firms and the government is the most important game relationship. But what’s the fact?

The replacement of game among firms with game between firms and the government is verified by materials of investigation. Not only the motivation of location but also the technology promotion of firms reflects the shadow of the government. Policy privileges can bring direct benefits as “policy rents” and infrastructure construction facilitated by them can reduce transportation cost as to lower the “iceberg-cost” that melts in the course of transportation. Tab. 5 further explained that even for the “private business” such as technology promotion, firms receives the most support from the government while the guilds and peer firms—which are thought to be the important external sources for usual industrial clusters—are not the major channel from which firms in development zones obtain support.

The government stimulates FDI to enter development zone, aiming at making profits from it. Once a firm locates in the development zone, it actually has launched a Williamsonian specific investment and thus not able to quit without any loss (Williamson, 1985). Meanwhile, firms inside

development zones will face the risk of “hold-up.” However, different from Brazil (Meyer-Stamer, 1999), Chinese local governments make reliable commitment. The bounding mechanism is based on the reputation of repeated games and long-term benefits of job opportunities and GDP growth. Besides, at the “war of capital-attraction”, the possibility of contraction-violation is largely reduced and there is rarely the situation as mentioned by Oman (2000) about non-transparent policy and government corruption in the FDI competition based on fiscal and financial privileges. According to statistics of samples, 83.7% firms feel satisfactory for the services promised by the government; 76.8% firms have realized their expectation for entering development zones; the efficiency of communication between firms and the government is recognized by 93.1% firms.

In short, under the assumption of policy rents, spatial concentration is not the prerequisite for interaction among related firms. Development zones have become the space for games between firms and the government. Once the game structure is fixed and the policy privileges promised by the government become reliable due to the repeated games and the balance between short and long-term benefits, then firms in development zones are equipped with cost advantages compared with those outside the zones and thus this kind of institutional enclave becomes an incentive-compatible growth model.

## **6.2 The second source of performance for development zones and firms in them: technology improvement and promotion**

The results in part 5 show that selection of technologies for development-zone firms has significant influence on firm performance. Here we will conduct further analysis on that. Tab. 5 has given the ways of technology promotion in firms under investigation. With regard to the ways of technology promotion, increasing investment on technology promotion and improvement is the main choice for firms and the second choice is labor training of technologies and introduction of technicians. Joining capital or purchasing technologies between firms is not the primary choice for firms in technology promotion. In firms that recently are taking technology promotion, product promotion is the major content and followed is to run new businesses. The manufacturing process and existing technology are also firms’ major objects for improvement.

Tab. 5 the resources of help for technology promotion and ways of technology promotion in firm in development zones along the Yangtze River

Resources of help	Number of firms	Ways of technology promotion	Weighted value	Number of firms
Governmental institutions	62	Increasing investment on technology improvement and promotion	210	93
banks (except for financial support)	56	Purchasing technologies	42	18
Trade unions/guilds	21	Joining capital	41	15
Raw material suppliers	34	Training for labor technology	111	56
Dealers	42	Introducing technicians	143	65
Peer companies	27	Raising pay of technicians	92	44
Other supports	8	Others		
N/A	120			

To survey on the relationship between the specific choice of technology and performance of firms that have already gone through technology improvement or promotion, we composed the regression model (2), in which the explained variable is firm performance (*FPER*) and the explaining variables are *TECC<sub>m</sub>* (for which,  $m=1, 2, 3, 4$ ) <sup>①</sup> and *TECS*, respectively standing for the order  $m$  of technology choice and the range of technology choices. There is the degree variable *TECI<sub>n</sub>* (for which,  $n =1, 2, 3, 4, 5, 6$ ) to measure the importance of order  $n$  of choice of technology improvement.<sup>②</sup> Similar to the model above, firm scale (*FSIZE*) and firm level (*FLEV*) are controlled variables.

$$FPER_i = \beta_0 + \sum \alpha_m TECC_{mi} + TECS_i + \sum \lambda_n TECI_{ni} + \beta_1 FSIZE_i + \beta_2 FLEV_i + \varepsilon_i \quad (2)$$

Regression results in Tab. 6 indicate that among various improvements and promotions in firms, improving products (by introducing new or more complicated production lines) (*TECCI*) shows a significant influence on firm performance (see regression (1) and (3) to (5)), second to

<sup>①</sup> The items of technology promotion investigated in this paper includes “firms improve products (by introducing new or more complicated production lines), firms improve the manufacturing process, firms start new business lines (such as new designs, new market development, new self-made brands), firm’s technology status.” Since there are multiple choices, variables here are not multiple-category dummy variables but independent individual dummy variables.

<sup>②</sup> There are 6 ways of technology promotion involved: “increase investment on technology promotion and improvement”, “purchase technologies”, “joint capital”, “carry out labor technology training”, “introduce technicians” and “raise the pay of technicians”.

which is the status of technology promotion in firms (*TECC4*) that has significantly enhanced firm performance (regression (1) with 10% significance). Other choices of technology promotion, such as improving manufacturing processes (*TECC2*) and starting new businesses (*TECC3*) as to improve technology level of firms have insignificant influence on firm performance. To explain this, improving manufacturing processes and starting new businesses involve big risks and their influence on firm performance is hysteretic. Space of technology promotion is positively and significantly related to firm performance (see regression (2)). However, various ways of technology promotion as a whole exerts little influence on firm performance ( $R^2$  after adjustment is too small to be reported in Tab. 6.), and only “improving investment on technology promotion” (see *TECII* in regression (3) and (4)) has direct influence on firm performance. Here, we state hypothesis 3 in details as: influence of technology promotion on firm performance mainly comes from product improvement and investment on technology improvement by firms.



Tab. 6 Technology promotion and economic performance of firms in development zones

Variables	(1)	(2)	(3)	(4)	(5)
TECC1 (improving products)	0.404 (3.01) ***		0.306 (2.09) **	0.342 (2.40) **	0.297 (2.14) **
TECC2 (improving processes)	0.138 (1.01)				
TECC3 (new activities)	0.157 (0.18)				
TECC4 (situation of technology promotion)	0.273 (1.69) *				
TECS (technology space)		0.164 (2.33) **			
TECI1 (increasing investment on technology promotion)			0.105 (1.88) *	0.119 (2.16) **	0.066 (1.23)
Fsize (firm size)			0.0002 (1.67) *		0.0001 (0.96)
FLEV (firm level)		0.150 (4.36) ***			0.131 (3.14) ***
CONS (constants)	3.268 (22.82) ***	2.766 (15.22) ***	3.281 (20.20) ***	3.303 (21.49) ***	2.878 (14.07) ***
Ad-R <sup>2</sup>	0.085	0.206	0.125	0.107	0.220
F value	3.66	15.4	4.68	6.01	6.35
samples	116	112	78	85	77

Note: same as Tab. 2

### 6.3 The decisive factor of technology promotion for firms: spatial concentration effect and firms' choice of technology

We will keep surveying the impact of spatial concentration of firms in development zones along China's Yangtze River on firms' selection of technologies. We put the extent of technological choice of development-zone firms as the explained variable. <sup>①</sup> On the other hand, we put those

<sup>①</sup>A degree variable is constructed based on the different degrees of technology promotion in firms under survey. Technology promotion in firms include improving original technologies, starting new business operations (such as

characteristics that reflect government-led spatial concentration of firms as the explaining variables, which include: 1) Motivation (MOTV), which comprises of four sub-variables: MOTV1, motivation in terms of factor costs, that is, the coordination ability and cheap labor; MOTV2, policy privileges, including land and tax privileges; MOTV3, infrastructure convenience in development zones; MOTV4, potential of domestic market. <sup>①</sup>2) The main bodies of aid (AID), which is used to examine the impact of related factors of spatial concentration for development-zone firms on technology promotion. AID is further divided into three sub-variables: aid from the government (AID1); aid from the related companies in upper or lower reaches (AID2) and aid from peers and guilds (AID3).<sup>②</sup> 3) Ways of technology promotion for firms (WAY), which is used to examine whether the ways of technology promotion have exerted influence on the scale and space of technology promotion in firms. This variable has three sub-variables: increasing investment on purchasing or improving technologies (INVT), joint capital (COOR) and technician training (TRAN). <sup>③</sup> With these variables, we can construct a model of decisive factors for technology promotion in development-zone firms.

$$TECC_i = \beta_0 + \sum \alpha_m MOTV_{mi} + \sum \lambda_n AID_{ni} + \sum \gamma_j WAY_{ji} + \varepsilon_i \quad (3)$$

In the model,  $m=1, 2, 3, 4$  respectively stands for the four motivations for firms to locate in development zones;  $n=1, 2, 3, 4$  respectively represents the three main bodies of aid for technology promotion in development-zone firms;  $j=1, 2, 3$  represents three ways of technology promotion in development-zone firms respectively.

The regression results are presented in Tab. 7. Regression (1) and (2) suggests that motivations for firms to locate in development zones have no significant influence on firm technology promotion. This also proves that the assumption of “policy rents” is robust. However, the government exerts a significantly positive influence in firm technology promotion (significant

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new design, new market development and new self-created brands) and the combination of the two. The three situations are assigned values respectively as 1, 2, 3 with higher value indicating more strength put on technology promotion.

<sup>①</sup> A degree variable is created based on the different degrees of technology promotion for firms under survey. Choices of technology promotion mainly include: improving original technologies, starting new businesses (such as new design, new market development and new self-made brands) and the combination of the two, the three choices of which are respectively given a value as 1, 2, 3. The higher the value is, the more powerful the technology promotion will be.

<sup>②</sup> These three variables are three independent dummy variables, the value of which will be 1 if any help from the four categories is received, and otherwise 0.

<sup>③</sup> Each item in the samples is assigned values in accordance with its importance (indicated by the number of asterisks). The more the asterisks are, the higher importance it has and the value will be higher.

at 1%, see regressions (1), (2) and (4)), which also further proved correctness of our hypothesis 1 and 2; that is, the major game relationship in development zones as industrial clusters is between the government and firms. The government functions by providing policy privileges, fund support and market information etc.. In addition, product exchange and competition between related companies has important impacts on choice of technologies (see regression (1), (3) and (4)). At last, within various ways of firm technology promotion, the way that firms choose to increase investment on purchasing new technologies or improving technologies together with the way of training technicians significantly affect technology promotion, while the way of capital cooperation has no significant influence on it (see regression (1) to (3) and (5)).

In summary, in development zones that government provide policy privileges, the government can provide powerful supports for technology promotion in development-zone firms through the resources under its control (such as credit support, technological support, policy privileges and so on). Nevertheless, related companies in upper or lower reaches as well as peer companies will play positive roles in technology promotion for firms although they do not necessarily concentrate spatially.

Tab. 7 spatial concentration effect and firm's technology promotion

Variables	(1)	(2)	(3)	(4)	(5)
MOTV1 (completion capacity and cheap labor)	-0.0127 (-0.90)	-0.015 (-1)			
MOTV2 (policy privileges)	-0.0144 (-1.03)	-0.0083 (-0.56)			
MOTV3 (conditions of infrastructure)	-0.016 (-0.68)	0.012 (0.48)			
MOTV4 (potential of domestic market)	0.013 (0.61)	0.0226 (0.98)			
AID1 (from the government)	0.3947 (2.41)**		0.406 (2.50)**	0.697 (4.39)***	
AID2 (from vertical companies)	0.51 (3.13)***		0.479 (3.02)***	0.713 (4.56)***	
AID3 (from guilds and peer companies)	0.585 (3.41)***		0.559 (3.30)***	0.642 (3.64)***	
INVT (increase investment)	0.160 (2.91)***	0.204 (3.58)***	0.158 (2.91)***		0.213 (3.79)***
COOR (capital cooperation)	-0.026 (-0.26)	-0.005 (-0.05)	-0.046 (-0.48)		-0.026 (-0.25)
TRAN (training)	0.079 (1.56)	0.153 (2.98)***	0.075 (1.51)		0.147 (2.9)***
CONS (constants)	0.608 (3.70)***	0.646 (3.71)***	0.427 (5.42)***	0.517 (6.42)***	0.609 (7.89)***
Ad-R <sup>2</sup>	0.326	0.234	0.329	0.2634	0.239
F value	12.75	11.6	20.85	29.97	26.4
samples	241	241	241	241	241

Note: same as Tab. 2

## 7. Conclusions and Policy Implications

The conclusions are as follows:

First of all, current firm cluster based on development zones stays in the state of “concentration”, not showing a clear feature of external economy brought by spatial concentration of related companies. Few firms in development zones form cluster effect with either suppliers or dealers, and spatial concentration has little impact on economic performance of firms. But spatial decentralization of related companies does not certainly mean there is no relation between them. Firm clusters in current development zones are not necessarily equipped with conditions for information exchange and knowledge spillover in traditional sense.

Secondly, in industrial clusters based on development zones, the game between firms and the government plays a crucial role. This game is repeated, which guarantees a good reputation of local government, not needing industrial associations to represent firms to precede collective negotiation with government. Still, we also find that the information exchange between the firms and the government and related companies not based on spatial concentration has a positive effect on technology promotion of firms. In consequence, even though those firms that interact with firms in development zones do not necessarily geographically concentrate, but it means the market proliferation effect of development zones as a special cluster is coming into being.

Thirdly, after firms locate into development zones for common benefits, namely “policy rents”, their technology promotion becomes another source of firm performance in development zones. Hence development zones serve as both institutional carrier as well as technological carrier.

Consequently, government-led economic development zones differ with general industrial clusters to a great extent. Here, the government plays leading role, being both the “visible hand” and the “supporting hand”. Nonetheless, if firms in development zones rely too much on “policy rents” provided by the government, when “policy rents” fade away, the non-political spontaneous ability stands out to importance. In recent years, after implementation of policies such as “two-tax in one” and “land bidding and auction selling” etc., although “policy rents” benefits have disappeared and new *Labor Law* (enacted on January 1, 2008) increases factor costs, firms in development zones along the Yangtze River do not “fly away” because their spillover benefits based on technologies and markets have increased as well. For this reason, in the background of

industrial transfer and policy adjustment, economic development zones either lose competitiveness against new development zones due to dissipation of policy rents or form cluster effect and become industrial clusters equipped with sustainable development capacity. In this sense, development zones as the economic growth polar fostered by the government, similar to other “transitional institutions”, they undertake capital-attracting mission in the special stage of Chinese economic development. Once development zones form industrial clusters with self-organization ability, they have their mission fulfilled.

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